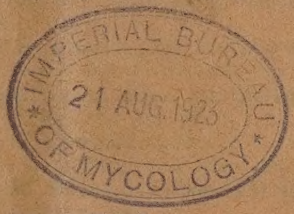
Vol. 5.] January—June, 1923. [No. 1.

AGRICULTURAL CIRCULAR

Issued by the
Department of Agriculture, Fiji.



PRICE, ONE SHILLING.

BY AUTHORITY: S. BACH, GOVERNMENT PRINTER, SUVA.
1923.

DEPARTMENT OF AGRICULTURE.

LIST OF STAFF.

Superintendent of Agriculture	Hon. H. B. Lees, M.C., M. Inst. C.E. (Acting).
Government Entomologist	H. W. Simmonds, F.E.S. (Acting)
Government Veterinary Officer	C. R. Turbet, B.V.Sc., Sydney.
Inspector of Produce	E. S. Gordon.
Inspector of Plantations	G. H. V. Saunders.
do.	C. T. McNamara.
Inspector of Plants (Lautoka)	R. H. Phillips.
do. (Levuka)	Capt. Wallack.
do. (Rotuma)	C. Jacobsen.
Inspector of Stock (Suva)	E. S. Gordon.
Second Class Clerk	A. B. Ackland.
Fourth Class Clerk	Amoni Bari.
Manager, Rice Mill	J. P. Tarby.

AGRICULTURAL CIRCULAR

ISSUED BY THE

DEPARTMENT OF AGRICULTURE, FIJI.

Vol. 5.] JANUARY—JUNE, 1923. [No. 1.

COTTON IN FIJI.

During the month of March and early part of April, an inspection of all the cotton areas from Tavua to the Sigatoka river was made, with a view to ascertaining the area actually planted and the condition of the crop in general so that the Government would be in a position to make the necessary arrangements for the collection and storage of seed-cotton and the ginning of same.

Ginning, &c.—Three gins complete with motive power have been ordered from England and should arrive by the s.s. " Port Kembla " during May. It is proposed to erect a central ginnery at or near Lautoka to treat the crop from the northern and western districts of Vitilevu.

The crop from Vanualevu is small and will be ginned at Suva.

Area inspected.—An area estimated at 620 acres was inspected, and taking everything into consideration a great deal of care is being taken by the planter to keep down the growth of weeds.

Cultivation and selection of land for planting.—It is to be regretted that a sufficient amount of care has not been taken in the selection of suitable land for the growing of sea-island cotton. In consequence, quite a large area under cultivation will yield only a light crop, but where care had been taken the cotton looks very well indeed and should yield a good crop.

Drainage.—Drainage has not been done to any great extent, and in the majority of cases only shallow spade drains have been put in, only sufficient to carry off the surface water.

Cotton Inspector.—The services of a cotton inspector have been secured, and this officer should arrive in Suva at an early date.

Transport, ginning, &c.—Arrangements as regards the collection at fixed stations, and the transport and ginning of seed cotton will be made shortly. Information on these points will be widely advertised for the information of growers.

In regard to the cotton industry, it may eventually prove that some other variety than Sea Island may be a better commercial proposition in Fiji, and in this connection " Durango," a long staple upland variety is highly spoken of, whilst the following report from the Imperial Institute on Kidney variety grown at Ba is of interest:—

Description.—Unginned cotton, yielding 28·5 per cent. of lint.

Lint.—Clean, cream-coloured, free from stains, fairly lustrous, and harsh.

Seed.—Large, chocolate-coloured seeds, free from fuzz, and united in characteristic kidney-shaped groups. The average weight of a single seed was 0·14 gram.

Strength.—Good.

Length of fibres.—From 0·8 to 1·5 inch, mostly from 1·0 to 1·4 inch with an average of 1·2 inch.

Commercial valuation.—The ginned cotton was valued in Liverpool at 17·00d. per lb, with " middling " American cotton at 14·50d. per lb, and " good moderately rough" Peruvian cotton at 16·50d. per lb (December, 1922).

Remarks.—This cotton is of good strength and length, and of rough and harsh character, resembling in this respect a moderately rough Peruvian cotton. Such cotton would meet with a ready sale in the United Kingdom.

BANANA EXPERIMENTS.

By H. W. Simmonds, F.E.S., Acting Government Entomologist.

The following banana experiments against the borer *Cosmopolites sordida* were carried out in the garden of the Agricultural Department, Suva:—

The object was to see whether it would be possible to obtain a stand of bananas clean of borer *Cosmopolites sordida*, using suckers from affected plots. With this object in view the garden (which had had no bananas growing in it for many years) was dug up at both sides and back, and in July, 1921, the following suckers were placed in it:—

(*a*) Four Blue Javas taken from the Cottage Home. This was a nice looking block bearing good fruit, but with considerable borer present;

(*b*) two Ladies Fingers. The plants these were taken from were very poor, and borer was also present;

(*c*) three Cavendish. These were taken from a block very badly infected with borer.

All were carefully scrubbed and every effort made to see that no borers or eggs were present, yet despite these precautions three of the Javas and two of the Cavendish quickly showed by their failure to make growth, and yellowness, the presence of borer, and these were at once dug up and burned, borer being present in numbers in each.

The others went ahead well except that the remaining Java presently developed bunchy-top. This was unexpected as there was no bunchy-top present in the original clump or near, but since then two other clumps in the neighbourhood have developed the disease.

The other three plants went ahead well and threw some fine suckers. Two of these suckers were removed from the Cavendish and planted out—

(1) near the bunchy-top Java, and this one quickly developed bunchy-top itself;

(2) in a distant part of the garden, and this went ahead well.

A year later another sucker was taken off this plant and no sign of borer was found in doing so.

Just before the bunch on this banana was ready to cut, one of its suckers showed yellowness, and, on digging out, was found to be affected by the beetle. This was removed and burnt, and since then no sign of borer has been found in the plot.

So that, despite the utmost care in selecting and washing suckers, borer is likely to be introduced. Nevertheless, if prompt measures are taken and all affected plants dug out as soon as they show signs of being affected (and the majority do this within three months of planting) the disease can be so far kept under control as to have comparatively little effect upon the yield of fruit. Further, if suckers are taken from young plants in planting up there is far less risk of introducing borer than when suckers are used from old plants.

It is absolutely necessary that the ground shall be clean before planting, and to bring this about all old plants should be dug out and burned, at least a year before it is intended to plant up with bananas, meanwhile the land can be used for some other crop. The borer has never been known to fly, and infection takes place from diseased suckers and from beetles crawling from neighbouring plantations. To prevent this latter, traps can be set, consisting of pieces of banana corm laid between the two estates and examined underneath daily for adult beetles. New traps should be used and the old ones burnt every two weeks.

PARASITIC GASTRO-ENTERITIS IN YOUNG CATTLE.

By CHAS. R. TURBET, B.V.Sc., Government Veterinary Officer.

A disease of calves has recently come under my notice which unfortunately has resulted in the death of several of the calves affected. I have diagnosed this disease as being parasitic gastro-enteritis. No previous record seems to have been made concerning this disease in Fiji, but in most other countries it is widespread, and causes heavy mortality. Our aim should be to prevent its occurrence here where climatic conditions, and the nature of the country, are so favourable to the existence and spread of stomach worms.

Animals attacked.—All domesticated ruminants, and probably wild ruminants also. In Fiji cattle are most often infested; animals of all ages are attacked, but the young are far more susceptible and suffer far more severely from the ravages of this disease.

Symptoms.—The animals first appear less lively. They are feeble, growth is retarded in spite of a well-preserved appetite. In the course of time the symptoms of anaemia, dropsy and cachexia set in. The hair is rough and lustreless. There is an œdematous swelling between the lower jaws in the region of the throat. In the later course of the disease, diarrhœa is profuse. the fæces are dark, fluid and fœtid. The abdomen is large and pendulous.

Diagnosis.—This is done by excluding other diseases. Also by microscopical examination of the fæces for ova and embryos. Generally, however, a calf can be procured which has just died of the disease. The finding of the worms in the stomach is conclusive.

Anatomical changes.—The mucous membrance of the abomasum (fourth stomach) is swollen and œdematous, raised in gelatinous folds, reddened here and there, and beset with greyish white nodules the size of a pin's head. Erosions may also be seen up to the size of a finger nail. The mucous membrane may be covered with a thick flocculent deposit. The stomach worms may be found only by placing a small amount of the stomach contents in a shallow glass vessel and then well diluting with water. The small worms may then readily be seen. The mucous membrane of the small intestine, especially in the first and middle portions of the latter, is swollen and loose, forming coarse transverse and longitudinal folds; it is reddened in spots.

Cause.—Three small nematod worms cause the disease in cattle; these are *Hæmonchus contortus, Trichostrongylus extenuatus* and *Ostertagia ostertagia*. The worms vary in size from $\frac{1}{3}$ to $\frac{3}{4}$ of an inch in length. Their colour is from white to red. Some are very fine and slender, being almost invisable. It is this type which is so often overlooked on post mortem examination by stockmen. The most commonly found worm is *Hæmonchus contortus*, the twisted stomach worm. The characteristic bent, twisted appearance, with the red stripe throughout its length, makes the identification of this worm easy. They actually cause disease in the following manner:—

(*a*) By puncturing the mucous membrane at their point of attachment;
(*b*) by feeding upon the blood of the host and thereby producing anæmia;
(*c*) by the absorption of toxic metabolic products of the parasites.

The Life History of the Stomach Worms.

The ova or eggs pass out from the adult worm in the stomach of the host. The eggs are either hatched within the host or pass out with the fæces and develop into embryos externally. These embryos are very motile. They climb damp grass blades, are taken in by young stock when feeding and develop into adult worms in 2 to 3 weeks.

Treatment.—In order to keep this disease under control it is necessary to carry out systematic treatment. There are many standard methods in practice. The following is widely used. All food is withheld from the animal to be treated for about twenty hours. A drench prepared as follows is then given:—

Take an enamel bucket, put in five pints of carefully measured rain water. In this dissolve one ounce of bluestone (copper sulphate) and later on add one ounce of common fresh mustard. It would be advisable to warm the water to accelerate solution of the copper sulphate, but it should be quite dissolved and the solution thoroughly cooled before the mustard is added.

The dose of this for a yearling is eight fluid ounces, a lesser proportion for younger calves. Keep well stirred the whole time. The above quantity is sufficient for about twelve yearlings or more calves.

Eight fluid ounces equals one breakfast cup. Withhold all water for some hours after administering the drench.

Unless a systematic drenching is kept up for at least six months, it is of little use to give a single drench, as it is possible for the calf to be reinfested with stomach worms two days after drenching. All calves in the herd should be drenched as otherwise apparently healthy calves would be a source of reinfection to others. The treatment should be repeated within 18 days, and then monthly for at least six months.

Prophylaxis.

In the matter of prevention many schemes are adopted—

(1) rotation of the paddock under crop and pasture;
(2) the use of the affected paddock by unsusceptible animals, such as horses and pigs for periods;
(3) drenching;
(4) drainage of paddocks;
(5) dressing the pastures with common salt, 400 lb to the acre, has given good results in some countries, also the addition of lime in the same quantity. Iron sulphate, 300 lb to the acre, is good, and also acts as a fertiliser.

A combination of these schemes is most likely to give the best results.

TOBACCO DISEASE.

By H. W. Simmonds, F.E.S., Acting Government Entomologist.

Tobacco plants from Bua province were found to be affected with a stem disease which causes swellings at the nodes and the production of large numbers of small leaves, something after the appearance of bunchy-top in bananas.

On opening one of the swellings, a whitish larva will be found inside. This is the larva of a moth, and is a well-known Indian pest *Phthorimæa heliopa*, and which I also found doing much damage last year at Wallis and Futuna Islands.

Treatment.

Destruction of all old tobacco plants, preferably by fire, after gathering of crop and all other *Solanaceæ*, so as to destroy all breeding places until the following season.

After seed-beds have been established, the following treatment is recommended in the Philippines:—

The best and most practical method of control is to pull up and destroy infested plants, if young; though vigorous plants can be dealt with by making a longitudinal cut on the swollen part of the stem, with a clean, sharp, thin-bladed knife to expose and kill the larva. No further treatment of the plant is necessary. Seedlings, especially those that have been kept for a long time in seed-beds, are severely attacked, hence it is important to transplant them when about 6 inches high and to remove all shoots growing at the base of the plant and on the axils of the leaves. Spraying with Paris green does not prevent the moth from ovipositing on the stem.

ENTOMOLOGICAL AND MYCOLOGICAL NOTES.

By H. W. Simmonds, F.E.S., Acting Government Entomologist.

The white scale found heavily infecting cotton at Labasa has been identified as *Hemichionaspis minor*, a species widely distributed in Fiji.

The following insects are interesting as having been bred out of ripe cotton bolls. All are probably harmless scavengers:—

Lepidoptera.—Stathmopoda synchrysa Meyr. sp. n.; *Labdia epizona* Meyr; *Labdia calida* Meyr; *Labdia allotriopa* Meyr. sp. n.; *Decadarchis heterogramma* Meyr.; *Limnoecia inconcinna* Meyr.

Coleoptera.—Scolytidæ ; Hypothenemus gossypii Samp. sp. n.

House Fly Parasites.

About January, 1911, Mr. F. W. Terry, of Honolulu, sent a number of *Spalangia* parasites of the house fly to Mr. Jepson, then Government Entomologist in Fiji. This is doubtless the origin of the parasite discovered a year ago present at Messrs. Robinson & Ballantyne's stables in Suva.

Fruit Fly attracted by Light.

The fruit fly *Dacus passifloræ* is attracted by light and some half dozen examples (of both sexes) were taken on the evenings of the 18th and 19th March at a small electric globe. They probably came from guavas, which were in fruit in the garden at the time.

In October, 1922, a considerable consignment of pineapple suckers was landed in Suva. These were found to be affected with several diseases, including a nematode worm and a rot which was identified as *Thielaviopsis paradoxa* (De Seynes). They were therefore condemned and burnt. This identification has now been confirmed by the Imperial Bureau of Mycology as follows:—

(*c*) This is *Thielaviopsis paradoxa* (De Seynes) Von Hoehnel as suggested by you. It is the cause of the destructive pineapple rot.

Cotton bolls suffering from a rot apparently carried by the bush bugs *Tectocoris lineola* which live normally on *mulamula* were forwarded to the Imperial Bureau of Mycology, and the following is a copy of their report:—

Cotton attacked by a disease apparently carried by bush bugs (*Tectocoris lineola*). The lint is permeated and destroyed by a copious growth of a fungus belonging to the genus *Cephalosporium*. Doubtless this is one of the numerous cases where puncture of the boll by an insect is followed by a rot due to a fungus or bacterium. The latter is either carried into the boll by the insect (*e.g.*, boll worms) or its spores germinate in the exudate around the puncture made by sucking insects and the hyphæ grow down the channel to reach the interior. All sorts of fungi can destroy the lint when they reach it in this way, *Aspergillus, Rhizopus, and Diplodia* being the most usual, though several others have been recorded, all or nearly all of which are unable to injure sound bolls. Hence control of the insect prevents the disease. In some cases the greater part of the injury caused by the insect is due to these secondary fungi.

Lantana Feeding Insects.

Many complaints having been received of the continued spread of Lantana in Fiji despite the partial control exercised by the *Agromyzid* fly introduced from Hawaii some years ago, the Government Entomologist approached the Hawaiian Sugar Planters' Association with a view to trying one or more of the other insects introduced into Hawaii for the control of this pest in that country.

Through the courtesy of Mr. O. H. Swezey of that Association two consignments have now been received. The first in December when some 18 pupæ of *Thecla echion*, whose larvæ destroy the flowers and buds of lantana, were landed. Many of these had emerged en route, and only seven were liberated near Suva under somewhat unfavourable conditions. In May, a further consignment consisting of fifty-nine more *Thecla echion* and one hundred and ten *Thecla agra*, a species with similar habits, were received.

The *Thecla echion* were forwarded to Taveuni to be liberated there, whilst some eighty-six of the *Thecla agra* have now been set free close to Suva.

It is much to be hoped that these two species will succeed in establishing themselves in the areas where they were liberated, and from whence they can then be distributed over the remainder of the group.

CITRUS INDUSTRY IN FIJI.

By H. W. Simmonds, F.E.S., Acting Government Entomologist.

In the last number of the *Agricultural Circular* attention was called to the possibilities of establishing a citrus industry in this country. In connection with this there is a valuable use for small and waste fruit for the production of orange oil. A considerable trade has been worked up for this commodity in the West Indies, and the following records of prices should be of interest:—

The first shipment from Jamaica in 1906 fetched in London from sweet oranges 7s. 7d. per lb, and from bitter fruit 8s. to 8s. 3d. In 1919 it was still quoted 7s. to 8s. 6d. In 1920 it had risen to 15s. to 16s. per lb, dropping in 1921 to 11s. for sweet and 8s. 6d. for bitter. In January, 1922, it dropped suddenly to 8s. 6d. sweet and 7s. 6d. bitter, but had recovered to 10s. to 11s. per lb in March. As showing the value of this by-product, Jamaica in 1920 exported oil to the value of £90,000, and in 1921 to the value of £40,000.

A paper taken from the *Agricultural News* is published in this number on the manufacture of this commodity. Notes are also given showing the growth of the citrus industry (principally grape fruit and oranges) in Porto Rico.

There is undoubtedly a big market for both oranges and grape fruit in Canada, which at the present time imports these fruits almost exclusively from the United States of America. There is no reason why Fiji fruit should not carry to there, as Jamaica has for 25 years sent oranges to England. Canada consumes 322,000,000 oranges, equal to 2½ million cases a year, and there is no reason why a considerable proportion of this trade should not come to Fiji, the more so that Fiji fruit ripens at the opposite season to the North American, coming in when fruit is at its scarcest and prices their highest in Canada.

If, however, Fiji is to cater for this trade, it will be necessary to grow proper budded stock of two or three good commercial varieties only, to grade with the utmost care and send no fruit showing blemishes of any kind, and to establish orchards in groups where all work will be done under careful inspection and uniform conditions. If this is done there are few crops which show promise of such big returns per acre, or offer such possibilities to the man with a limited capital.

The following notes on the growth of the citrus industry in the West Indian Island of Porto Rico should be of interest, showing as they do the big possibilities lying before Fiji in this direction.

Fijian fruit, ripening in March and April at the opposite season to the West Indies and United States of America, comes in at a season when all fruit is scarce in North America, and thus at its highest price.

In porto Rico in the period 1914–1917 oranges were found to yield maximum price returns to growers in February, March, April and October. Grape fruit in August, September, October, March and April.

Porto Rico has exported as follows:—

Year.	*Oranges.* *Cases.*	*Grape fruit.* *Cases.*
1910	296,058	48,441
1911	349,442	96,189
1912	277,422	118,937
1913	353,690	216,247
1914	348,927	206,200
1915	200,311	276,583
1916	404,451	296,645
1917	503,318	435,890
1918	603,226	549,125
1919	373,679	417,369
1920	336,625	419,629

This shows a steady increase in the output of the tropical Porto Rico fruit in competition with fruit from Florida and California of approximately the same season.

WEST INDIAN CITRUS OILS AND THEIR RECOVERY.

The following appeared in *The Agricultural News*, 5th March, 1921, Vol. XX, No. 492, p. 68:—

The vegetable essential oils constitute a class of plant products of considerable importance and value. In the British West Indies the export of lime oil and orange oil forms a source of revenue to the various islands where citrus trees are grown. It is important therefore that the best and most profitable means for the recovery of citrus oils should be practised in these islands.

In order to understand the relative advantages of the different means that have been proposed for obtaining the essential oils of citrus fruits, something must first be known of their chemical constitution. Essential oils, as a class, usually consist of two fractions—(*a*) a liquid fraction of comparatively low boiling point, and of little or no odour, which is known as "the terpene constituent"; (*b*) a second fraction which is composed of a mixture of highly odorous liquids and solids dissolved in them, and collectively termed "the oxygenated constituent."

The composition and chief physical properties of West Indian oil of limes have been described by Tempany and Greenhalgh in the *West Indian Bulletin* (Vol. XII, p. 498). Lime oil, as freshly expressed from limes by the ecuelling process, consists chiefly of a terpene known as limonene, together with an oxygenated liquid constituent called citral (2 to 10 per cent.) and certain solid substances which are dissolved in the oil.

On distillation, ecuelled lime oil first yields limonene, and other terpenes which pass over at a temperature varying beween 170° and 180° C. The residue in the distilling vessel now contains chiefly the terpeneless oxygenated constituents of the oil, and has a much stronger odour than the original oil. It rapidly decomposes, however, on further heating, so that instead of distilling over unaltered, the oxygenated constituents give rise to decomposition products, of which the volatile components become mixed in the distillate. Finally, a solid residue of a blue colour is left in the distilling vessel. This consists of the solid oxygenated compounds originally present in the oil, together with decomposition products.

In the recovery of lime oil by distilling lime juice or lime pulp, the product obtained consists mainly of the terpene constituent of the oil as it occurs in the lime fruit, together with some of the oxygenated constituents and their decomposition products. In fact, it resembles greatly the distillate obtained when ecuelled lime oil is distilled, but it probably contains a greater amount of the decomposition products than does this oil.

The writer, during an official visit to Dominica in November, 1920, attempted to distil lime fruit pulp under reduced pressure, in order to discover whether or no distillation at low temperature might minimise the decomposition of the oxygenated constituents. Several distillations at pressures equivalent to about 10 centimetres of mercury were carried through. The temperature in the distilling flask at this pressure was about 53° C. The product obtained, however, apparently did not differ very much from ordinary distilled lime oil. It would seem, therefore, that distillation at however low a pressure would cause some decomposition of the valuable oxygenated constituents of lime oil. This explains the lesser market value of distilled lime oils as compared with ecuelled or mechanically expressed oils. Possibly during distillations of lime juice or lime pulp, the presence of water in excess has some effect in accelerating the decomposition of certain of the oxygenated compounds by heat. Such a property of water is well known to organic chemists, who have given the name hydrolysis to a similar

type of chemical action, in which water under certain conditions brings about the decomposition of certain organic compounds when it is heated with them. This is to some extent upheld by the following account of a process for obtaining citrus oils, which claims to yield a product as good if not better than that obtained by mechanical means.

A patent was granted in November, 1920, by the United States Patent Office to F. A. McDermott for a new process for citrus oil recovery. A description of the process is published in the *Perfumery and Essential Oil Record*, January, 1921, page 18, from which the following account is taken:— The specification indicates that the new process is designed for the extraction of oils from the rind of citrus fruits, chiefly oranges and lemons, and aims at recovering a larger proportion of oils from a given mass of rind than can be obtained by any other known process. In brief, the main operations consist, first, of removing the rind from the fruit with sufficient care so as not to rupture the oil glands; secondly, of drying the rind at a temperature below that at which the oil evaporates and, finally, of distilling the oil under reduced pressure in a current of steam.

The patentee lays stress on the importance of careful handling of the fruit during the peeling process, holding that rough treatment results in the loss of a large amount of valuable oil. The fruits are cut so as to remove the rind in three or four sections. These are then partially dried at low temperatures. Exposure to air on wire racks, under quiet atmospheric conditions, is a suitable drying treatment. When dry, the rind is finely comminuted by use of a cutting machine, and further to reduce the size of the pieces, subsequent grinding is recommended. These operations should be performed " at a low temperature, and in a quiescent atmosphere to avoid volatilizing the oils."

Distillation is performed in a special apparatus which consists of a vertical cylinder, into which the finely reduced dried rind is placed, connected with a condenser. A slow current of steam is passed up the cylinder, and the whole apparatus is exhausted of air until a pressure of only about 5 to 7 centimetres of mercury exists within it.

The patentee explains that the small amount of steam used serves merely as a carrier for the volatilized oil constitutents, and that the fundamental principle underlying the method of distillation described is that the various constitutents of the essential citrus oil are vaporised at such low temperature, and in the presence of so little water, that the highly aromatic oxygenated fractions are not decomposed, but pass over almost unchanged. Except for the absence of certain solid constituents normally occurring in mechanically-expressed citrus oil, the oil obtained by the new method should, according to the treatment, contain all the essential compounds in its make-up.

The resulting product is said to be " superior in flavour and odour to the oils obtained in manually practised methods, and much sweeter and better flavoured than those obtained by the agency of extracting solvents such as chloroform."

In order to give colour to the colourless products of distillation, the addition of pigmented materials from the outermost parts of the rind of the fruit, obtained by steeping these in some of the distilled oil, is recommended. Finally, to prevent the oil becoming rancid on keeping because of the decomposition of the terpene constituents, it is advised that a certain amount of absolute ethyl alcohol, equal approximately to 10 per cent. of the oil, be added to the distilled product.

The chief practical difficulty which to the writer appears to prohibit the employment of McDermott's process in the West Indies is in relation to

the tedious and expensive preparation stages, in which the citrus fruits are peeled, dried and comminuted before they are ready for distillation. Unless the citrus fruits are grown only for their yield of essential oil, there would seem to be no advantage in going to the trouble of removing the rind from the fruits before crushing, for where labour is cheap, and limes are grown for citric acid, the product obtained by a preliminary ecuelling is sufficiently remunerative to hold its own in spite of the stated superiority of the new extract.

SHADE FOR CITRUS TREES.

Observations were made during the year on two groves of citrus trees that have been growing under the shade of *Inga vera**. The fruits in the grove in the vicinity of Mayaguez were all borne singly and were very handsome, having kid-glove skin which was free from scab. The fruit on trees in the open was scabby and in clusters and far inferior to that in the shade. The same conditions were found in the other groves. The fruit on all trees growing in the shade of *Inga vera* seems to be less in amount than on trees growing in the open.—Report of Porto Rico Agricultural Experiment Station, 1920.

[*Note.—*Inga vera* is a leguminous tree of the Mimosa group native of the West Indies.—Ed.]

NOTES ON COCONUTS FROM PORTO RICO.

The co-operative experiment begun in 1915 on coconut palms set two years earlier to determine the effect of fertilizers on the growth and production of young coconut palms is being continued. Plats of 10 trees each receive semi-annual applications of complete and incomplete mixtures of chemical fertilizers, as well as tobacco stems and stable manure in combination with chemical mixtures. During the first 18 months of production the best yield was made by the plat to which common salt (sodium chlorid) only had been applied. Nine trees in this plat matured nuts in this period, while only two did so in the check plat. From four to five trees fruited in each plat which received incomplete fertilizer, and from four to nine trees in each plat which received complete fertilizer. In the year 1921 the yield from the check plat averaged but 11 nuts per palm, while the salted trees averaged 45 nuts per palm. Salt has been found to be so beneficial in this test that it is being tested on a much larger scale in an older coconut grove where records have been kept of the individual yields of several hundred trees for over eight years. It is suggested that coconut planters who wish to try this out on their own properties apply 3 to 4 pounds per palm every six months, distributing it well throughout the range of the roots.—Agricultural Extension Notes, Porto Rico, 15/12/22.

AIRLESS OR VACUUM STORAGE OF FRUIT.

Experimental Overseas Shipment.

At the invitation of Mr. H. Louey Pang and the Directors of the Greig–Allen Airless Storage System, a large gathering of fruit growers, fruit exporters, and representatives of large commercial firms interested in the development of markets in the East met at the s.s. "Victoria" at the Victoria Dock last Saturday morning to see the first commercial shipment overseas under the system. A consignment of 250 cases of various fruits is being forwarded to Hong Kong. It was originally intended (says the *Leader*) to send 400 cases, but owing to a mistake in the cubic measurement of the containers, 150 cases will have to be carried as deck cargo, and this fruit will be put off at Thursday Island. Great interest is being taken in the system, and the arrival of the fruit is now anxiously awaited. If the fruit arrives in a satisfactory condition great possibilities are opened up for the successful sea carriage of fruit. The initial installation is considerably less than that of containers containing ice, in which the ice has to be replaced continually, or of refrigerating machinery, and to a certain extent the personal element is eliminated, as is also the possibility of a breakdown in the machinery. The method of storing the fruit is simplicity itself. Air-tight containers made of wrought iron or steel in the shape of square tanks are used, the opening of which is bolted down securely. In order to withstand the external pressure of the atmosphere the tanks are stayed by means of a series of parallel strips of steel like the angle stays of a steam boiler. After the cases of fruit are placed in the containers the air is exhausted through a patent pressure until a vacuum of 29 inches of mercury is obtained As indicating the necessity of staying the containers it may be stated that when this vacuum is secured there is an external pressure on each side of the container of 200 tons, or a total pressure all over the container of approximately 1,050 tons. Four containers are being sent to Hong Kong, and are carried on the after deck of the vessel. The fruit consists of apples, pears, bananas, pineapples, grapes, oranges and lemons. In order to make the test thoroughly comprehensive the following varieties of apples are included in the consignemnt:—Annie Elizabeth, Alsopus Spitzenberg, Baldwin, King David, Ben Davis, Five Crown, Rymer, Shepherd, Schraeder, Tapeen, Seedling, Eley's Seedling, Munro's Favourite, Winter Strawberry, Clayton, Johnathan, while the pears consist of Josphine de Malines and Winter Cole. Mr. Pang expressed his appreciation of the interest shown by the large number of representative men present who had come along to see the demonstration of the system. He was personally very keen on the invention. He was also very keen on the development of the fruit trade with China, where the demand was so great that it presented immense possibilities. China annually imported over £1,000,000 worth of fruit, of which Australia contributed only a paltry £3,000 worth. Australia had not yet awakened to the possibilities and value of the oversea markets. She was decidedly not overproducing, but facilities for shipping to the East and China were urgently required. All the conditions in Australia to-day were favourable for the production of fruit of the highest quality, and once the difficulties of shipping and marketing were overcome Australia's future as far as fruit growing is concerned was assured.

Mr. Allen, the inventor of the system, said that for some time he had been experimenting, and in his own small way trying to evolve fresh methods of carrying fruit apart from refrigeration. Under this system he had kept

Washington Navel oranges for twelve and a half weeks, and they had opened in perfect condition. This was the first commercial shipment under the airless storage system, and neither the growers nor the Government had been asked for assistance. If the shipment was successful it was then the intention of the company to ask for the assistance of the public by the flotation of a larger company in order to obtain funds for the successfully exploitation of the process. Mr. Greig, Mr. Allen's co-inventor, stated that he had not the slightest fears of failure. The scheme will be successful. Fruit can be kept indefinitely, and may be removed as required. Mr. Williams, solicitor for the company, also spoke. Tests at all times and under all conditions had in every instance proved successful. Tomatoes cut and quite ripe came out of the container at the end of a week in a perfectly wholesome condition. Tests are now being arranged for with milk. This is a future development, and the arrangements are now being made to have tests made at the university. The temperature of the containers may be increased or reduced, and it is considered that by a reduction and maintenance of the temperature bacterial action will be controlled. If milk can be kept indefinitely, then a great good will have been achieved for humanity. Under similar conditions bread may be delivered the following day hot and fresh as it came out of the baker's oven. The company was quite satisfied that the invention is a commercial proposition and a successful one.

Mr. Parnham, fruit exporter, of Parnham Pty. Ltd., stated that under glass containers wattle blossom, peeled bananas, rabbits' legs, fish, butter—perishable products—had been successfully kept for varying periods in a fresh and wholesome state. The potentialities of the system were enormous, as the human element was eliminated. Carelessness on the part of the ship's engineer would be a thing of the past. As the vacuum is created by water pressure when the vacuum failed all that was required to rectify it was the simple turning on of a tap, and it was again brought back to the condition required. It would only be a matter of time when every household would have a container connected with its water system, and fruit and other necessaries could be kept as long as desired. Captain Fisher, of the " Victoria," stated that the market in Hong Kong warranted experiments in the carriage of fruit being carried out. Hong Kong was only ten days' sail from the nearest point of Australia, although people in Australia did not realise its nearness. Government experts, fruit exporters, and other representative men present were all agreed on the immense possibilities of the system. Mr. Louey Pang is to be commended for his pluck and public spirit, and should the venture prove successful will have done much for the export fruit industry of Australia. Quite apart from the experiment in the successful carriage of fruit through the tropics, the endeavour to open up new markets for Australian products is to be commended, and it is the wish of everyone connected with the industry that Mr. Pang's efforts will be crowned with success.—*Weekly Courier*, Launceston, Tasmania, April 12th, 1923.

[The above extract from the Tasmania paper is printed at length as the subject is one of great interest to fruit growers in Fiji. Further information will be obtained.—Ed.]

CONTENTS.

COTTON IN FIJI 1

BANANA EXPERIMENTS, *by H. W. Simmonds*, F.E.S. 2

PARASITIC GASTRO ENTERITIS, *by C. R. Turbet, B.V.Sc.* 3

TOBACCO DISEASE, *by H. W. Simmonds, F.E.S.* 4

ENTOMOLOGICAL AND MYCOLOGICAL NOTES 5

CITRUS INDUSTRY IN FIJI 6

WEST INDIES CITRUS OILS AND THEIR RECOVERY 8

SHADE FOR CITRUS TREES 10

NOTES ON COCONUTS FROM PORTO RICO 10

AIRLESS OR VACUUM STORAGE OF FRUIT 11